
Space Weather Technical Forecast

Issued on Friday, 12 August 2022 at 00:19 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Geomagnetic activity lessening. Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with the largest X-ray flare measured at GOES16 being a long-period C1.2, peaking at 11/0657UTC from AR3077. This was one of two groups with some development observed in the 24 hours, currently manifesting as a Bxo/Beta, or possibly now a Cro/Beta. Another group of note was AR3076, which comprises the long-term southern penumbral spot but also a newly-developed northern cluster, becoming a Cai/Beta by the period's end. These were two of five sunspot regions on the current disc, with the remainder all stable bipolar or else unipolar groups. At the very end of the period a possible sixth sunspot - a new bipolar region - was also seen to develop near the meridian in the southern solar hemisphere, attaining Bxo/Beta complexity by the period's end.

No Earth-directed Coronal Mass Ejections (CMEs) were in evidence in available satellite imagery, this despite the long-period flare described above.

Solar Wind / Geomagnetic Activity: Earth appears to be transiting a region of space between fast wind streams at present, with an Elevated solar wind, but also a rising density and more variable phi angle than of late.

The solar wind speed remained Elevated, with slight measurement differences at the L1 satellites of DSCOVR and ACE, but overall showing a slight fall through 550km/s. The solar wind density rose over the same period, from background and narrowly into double figures ppcc by the UTC evening. The IMF rose to become slightly elevated, with a peak just shy of 10nT and with a north-south component of between +3 and -7nT, more often anti-aligned with Earth's field than not. The phi angle was mainly positive (away from the Sun) until 11/0930UTC, with a more neutral and variable orientation thereafter, possibly in a CIR-like environment between CH10/+ and CH12/+.

The net result of the above solar wind measures was a general increase in geomagnetic activity, from mainly Quiet to become Active, with provisional Kp peaks of 4o in the 15-18 and 18-21UTC intervals as a period of more prolonged negative Bz brought itself to bear.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV), as measured by GOES16, was at Background levels.

The high energy electron flux (greater than 2 MeV) was mainly High, with a peak of 1.46e4pfu at 11/1350UTC. The 24-hour integrated electron fluence was above Active throughout, with a slightly rising trend and with an observed value of 4.44e8 at 12/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is Likely to be Low, with a daily Slight Chance of M-class flares chiefly due to development in AR3077 and AR3076.

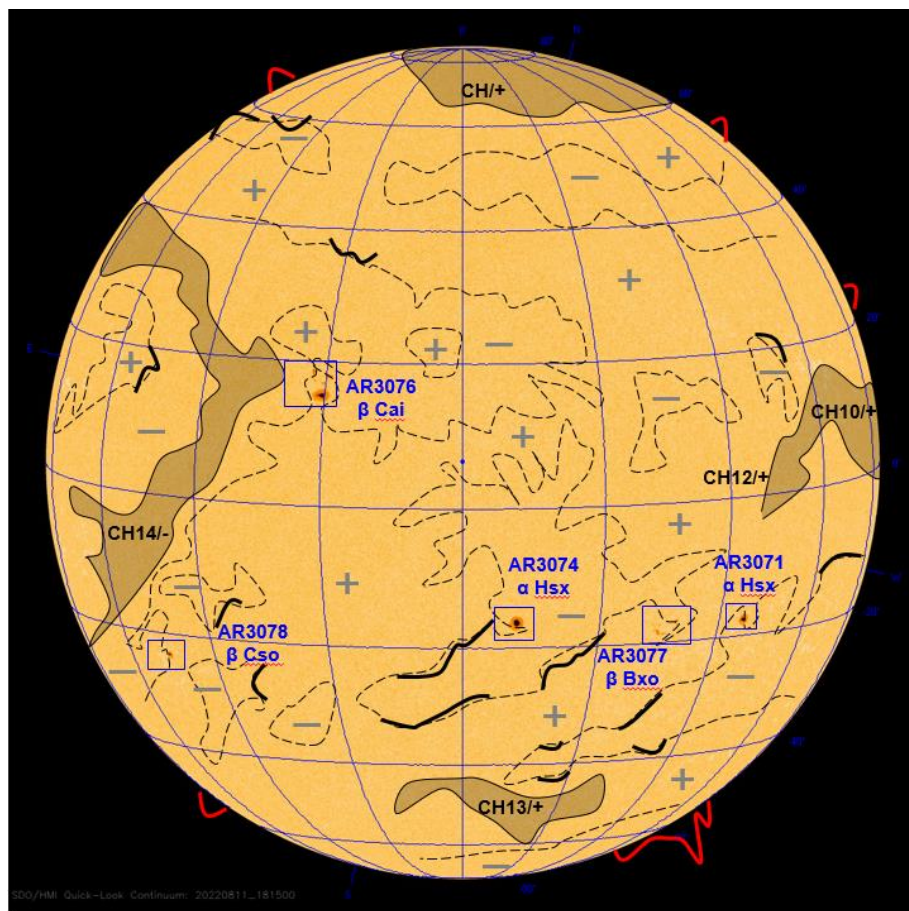
Solar Wind / Geomagnetic Activity: No CMEs feature in the current forecast.

Solar wind speeds are expected to peak at the start of the four-day period, with a possible entry into the final of a series of three fast wind streams due imminently (probably as a result of a transition from CH10/+ into CH12/+). The solar wind and resultant geomagnetic activity should decline into the coming UTC weekend, such that it should become more reliably Quiet through Saturday 13 August, from an early peak Slight Chance of G1, with Active intervals Likely on Friday 12 August.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels.

High energy electron flux is expected to remain above the High (1e3 pfu) threshold through much of the period. Electron fluence is also expected to remain above the Active (1e8 integrated pfu) threshold, with a Slight Chance of reaching Very Active.

Figure 1. Solar Analysis Valid 11/1815UTC.



Key: Filament ____, Prominence ____, Magnetic Field Line - - -, Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - $\beta\gamma$ - $\beta\gamma\delta$ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No CMEs feature in the current forecast.

Solar wind speeds for the period should peak during day one, Friday 12 August, as a result of the final of a train of three positive coronal holes becoming geoeffective (CH09, CH10 and now perhaps CH12). Transition between all three has been relatively difficult to diagnose for their polarities being the same, however the current solar wind environment shows a more typical CIR-like enhancement that may precede a fast wind.

There are some question marks still as to whether CH12 fully manifests at Earth or not, as it may have opened too late (roughly coming into existence on 07 August). STEREO A MAG and PLASTIC data perhaps hints that a SSBC is instead in course there, with a slow solar wind environment becoming established.

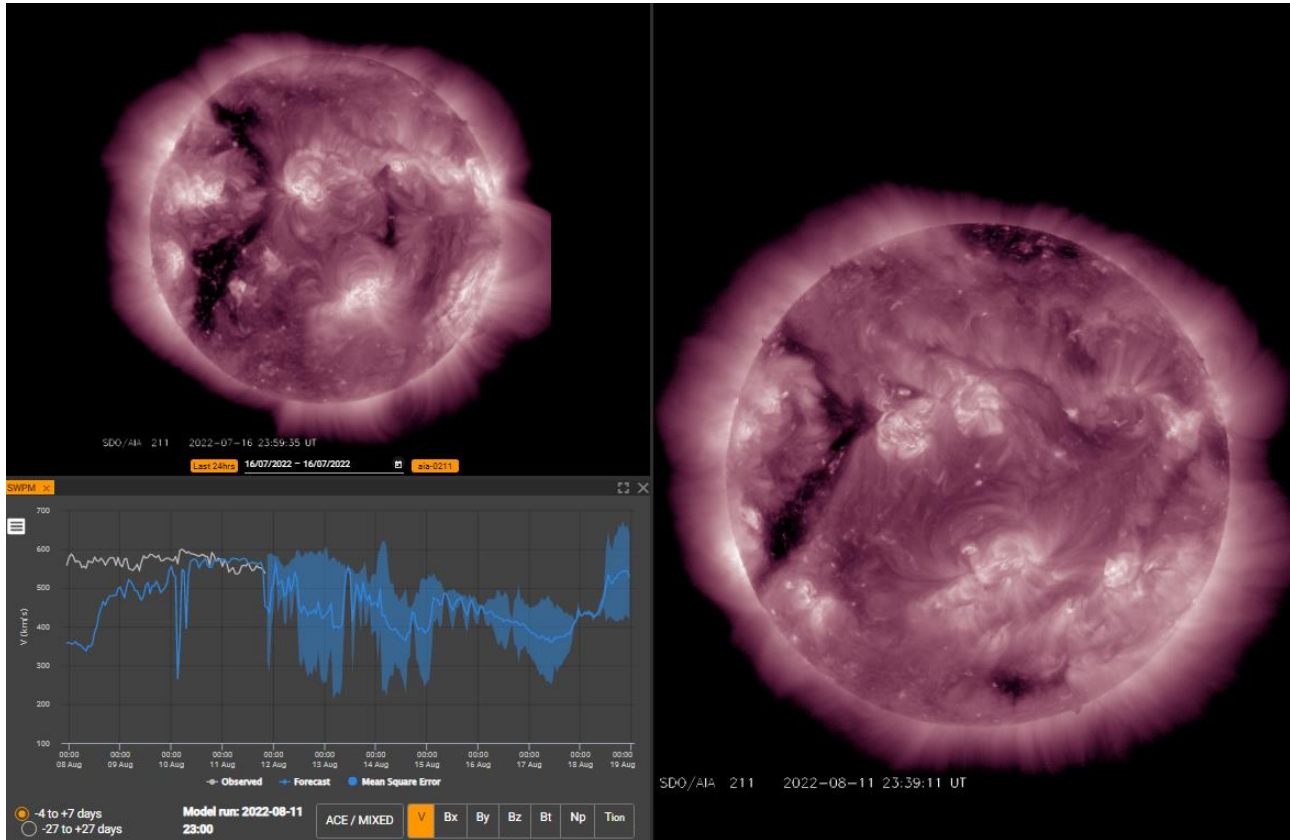
Geomagnetic activity for the four days should peak on day one with a Slight Chance of G1, and Likely further Active intervals, else falling to become more reliably Quiet later in the UTC weekend and into the new working week.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: AIA 211 imagery from past (top left) and current (right) rotations, showing dissimilarity in the current western hemisphere, in part because CH12/+ has only recently come into existence. Despite this, SWPM shows that the solar wind maps well with a month ago, probably declining sooner than on last pass given the closure of the minor coronal hole shown near centre-disc in the top left hand image.



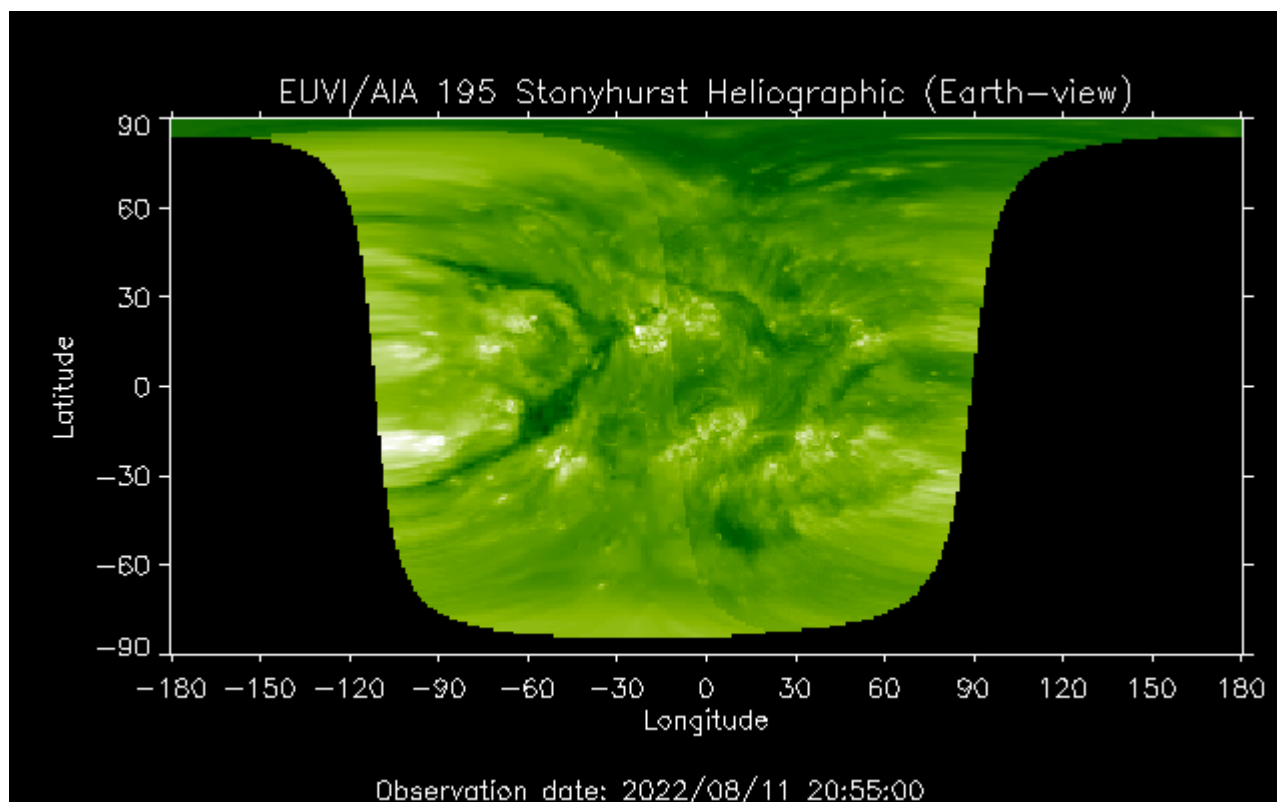
Radio Blackouts - X-Ray Flares:

Solar activity is expected to continue to be Low or Very Low in the absence of significant sunspot configurations. AR3077 (Cri/Beta) is the most notable region on the disc, however this has only proved capable of bottom-end C-class activity thus far, and further development and perhaps shear between the northern cluster and southern main spot would need to increase the risk of significant flares.

The proximity of STEREO A's perspective to that of Earth is now giving little further information about possible returning or developing bright flux regions over the eastern solar horizon, however there appears to be at least one inside two days' rotation that may slightly bolster the risks of flares, with a daily Slight Chance of M-class otherwise unmoved given the main active sunspot (AR3077) should persist on the front side throughout.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Cylindrical projection the Sun in 195 Angstroms, showing a prospective new region narrowly over the southeastern limb.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels, and is expected remain at this level through the period given the dearth of activity - this barring development of significant sunspot regions.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) levels are currently proving strongly reactive to the recent prolonged fast wind from the succession of CH09/+, CH10 and now perhaps imminently CH12. The past day's peak flux was recorded slightly in advance of where it ought to occur in the absence of significant geomagnetic activity (which would normally be in the late afternoon UTC at GOES16). This implies that if no redistribution has occurred as a result, then slightly higher 24-hour electron fluence levels may be realised on Friday 12 August, albeit probably a fair way short of Very Active.

The peak fluence for the four days ought to become established on day one, or else day two at the latest (Saturday 13 August) with no further impetus to increase counts in the forecast thereafter.

GEO Electron Environment	Level (cm ⁻² sr ⁻¹ day ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1x10 ⁸	Yes	100	90	80	70
Very Active	≥ 2 MeV ≥ 1x10 ⁹	No	1	5	5	1



Figure 4: Past week in GOES16 high energy electrons (top); as well as the driving solar wind at L1 (DSCOVR, middle); and observed fluence (bottom, blue dots). MOSWOC REFM's slight forecast rise in the next 24 hours is deemed realistic given the current diurnal oscillation could exceed $5e8$ integrated pfu if unencumbered by geomagnetic activity, which is becoming likely as the successive fast wind streams mature and then wane into the coming UTC weekend.

